N.A.C.A. BULLETIN

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APRIL 15, 1949

APPLICATION OF THE PRICE INDEX ADJUSTMENT CONCEPT TO DEPRECIATION CHARGES

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In the many discussions relating to recognizing in corporate financial statements or related statistical information, changes in the purchasing power of the dollar, illustrative applications of the selection and use of price indexes for this purpose have been notably lacking. The present article offers such an illustration, adapted from techniques of the economists and applied to depreciation charges. The author suggests that current cost basis depreciation so obtained be accorded limited use.

ALTHOUGH it has recently been the subject of intense, even heated, discussion, the problem of computing the depreciation charge under conditions of rapid and extensive changes in commodity prices is not a new one. During the ten-year period, 1925-1934, attempts at meeting the problem centered about revaluation of fixed assets through appraisal. It is only recently that some accountants have suggested that what they regard as a more realistic approach to depreciation requires the computation of the value of fixed assets consumed without recourse to revaluation of the assets themselves.

No Accepted Method of Adjusting Depreciation to Current Basis

While there has been some agreement among a segment of accounting practitioners on the need for some such adjustment of depreciation expense—or at least appreciation of the need felt by business managements—there has been little agreement on method. Among studied—and comprehensive—proposals for recognizing in the accounts and financial statements the effects of changed "real" value of the dollar are those made by E. Stewart Freeman in "Capital Price Adjustment Method for Deflating Inflated Profits" in the *N. A. C. A. Bulletin* for February 1, 1948, and by William Blackie in "What is Accounting Accounting for—Now?" in the *Bulletin* for July 1, 1948. For the purposes of this article, it is sufficient to note that both of these authors suggest, without going into the matter of selection and application, use of price indices to

DEPRECIATION OF ASSETS OF ENTERPRISES IN THE UNITED STATES
1919—1935
(millions of dollars)

Year	*Accounting measurement*	*Fabricants' conversion index* (1929=100)	*Economic measurement*	*Difference*
1919	$3,411	158.8	$5,416	$—2,005
1920	3,585	173.1	6,207	—2,622
1921	3,632	136.2	4,707	—1,075
1922	3,949	115.7	4,568	— 619
1923	4,044	126.8	5,130	—1,086
1924	4,154	121.9	5,063	— 909
1925	4,386	117.8	5,165	— 779
1926	4,861	115.7	5,625	— 764
1927	4,877	113.9	5,554	— 577
1928	5,175	111.1	5,750	— 575
1929	5,498	*110.1	6,164	— 666
1930	5,549	106.2	5,894	— 345
1931	5,481	98.3	5,390	+ 91
1932	5,119	91.3	4,675	+ 444
1933	4,879	90.1	4,399	+ 380
1934	4,745	98.3	4,664	+ 81
1935	4,721	99.9	4,716	+ 5

Source:—Solomon Fabricant, *Capital Consumption and Adjustment*, National Bureau of Economic Research, New York, 1938, Tables 29 and 31. (Index column above combines two indices shown separately in the foregoing source—see text of the present article.)

*The index number for 1929 is not 100. because it is a composite of two separately determined values one of which is 100.

EXHIBIT 1

effect appropriate adjustments for inflationary (or deflationary) changes in the dollar's value.

Some corporation reports recognize the problem and reveal attempts at increasing the depreciation charge by lump-sum charges to expense. These estimates are, of course, little more than guesses and have been referred to as aspects of "crystal-ball accounting." More properly, they are expressions of management judgment in an area where there are at present no real guide posts. Among the companies which have made depreciation adjustments of this general character in annual reports are Chrysler Corporation, E. I. Dupont de Nemours & Company, Libby-Owens-Ford Glass Company, R. J. Reynolds Tobacco Company, and United States Steel.

Size of the Depreciation Adjustment

It will be the function of this paper tc draw attention to the practical possibilities of index-based adjustment of depreciation at

cost to depreciation at current values by following to the point of accounting application a method of adjustment of cost values to current values familiar to economists in arriving at figures for national income. First, however, it may be helpful to get some idea of the picture which may result and the size of depreciation adjustment involved. For this purpose and before entering into the underlying method or into techniques for adjusting depreciation derived therefrom, it might be desirable to examine the dollar amount involved in such a depreciation adjustment. Exhibit 1, reproduced from the writing of Solomon Fabricant, shows an estimate of depreciation based on accounting practice (at cost) and also in terms of economic income using replacement value on a nation-wide basis for the main portion of the interwar period. It is apparent from this table that during the seventeen-year period 1919-1935, depreciation measured in terms of cost yielded a smaller charge than if it had been expressed in terms of current prices. In only five years, 1931 to 1935, was depreciation based on cost greater than the equivalent replacement value and the amount of difference in those years is extremely small by comparison with the rest of the years. The index column included in the exhibit is commented on later in this article.

Approach of the Economists

In considering methodology in this area, it will be worth while to turn to the techniques of economists who are concerned with preparing estimates of national income and are faced with problems regarding depreciation and inventory valuation not unlike those met by accountants and business management. Like the latter, they are thinking in terms of current rather than historical values. In preparing estimates of national income, an attempt is made to evaluate the flow of commodities and the services produced during a period of time and available for the residents of a country. This flow represents the sum of the payments made to the various factors contributing to production, such as payments made for wages and salaries, interest, rent, and profits. The aggregates are expressed or converted to expression in current prices. The contribution made by the business sector of the economy to total national income is reflected in business profits as derived from accounting statements and tax data.

To convert business profits as reported by the accountant to profit in current dollars as an element of income in the economic

WHOLESALE PRICE DEFLATORS FOR CAPITAL EQUIPMENT
1933-1942
(1939 = 100)

Group	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	Percentage Variation (1933-1942)
Industrial machinery	85.3	93.3	93.4	94.1	100.1	99.7	100.0	101.6	107.6	110.8	29.9%
Mining machinery	83.8	89.6	89.7	89.7	99.8	99.8	100.0	105.1	110.8	114.7	36.9%
Construction machinery	81.2	88.9	89.0	89.0	99.5	99.6	100.0	105.2	112.1	115.5	42.2%
General and miscellaneous machinery and equipment	83.1	91.1	91.3	88.9	100.9	101.3	100.0	101.0	109.9	115.6	39.1%
Engines and turbines	89.2	98.3	97.7	95.7	99.8	99.8	100.0	102.9	107.0	114.2	28.0%
Pumps and pumping equipment	95.2	95.5	92.5	93.1	99.1	100.3	100.0	102.5	112.3	123.0	29.2%
Machine tools	78.3	87.1	87.1	87.1	96.4	98.2	100.0	107.5	115.5	117.0	49.4%
Electrical apparatus and equipment	92.5	100.9	98.9	97.9	101.3	101.9	100.0	102.7	104.9	114.3	23.6%
Farm machinery and equipment	84.2	94.5	97.6	98.6	97.3	100.9	100.0	99.7	101.8	105.5	25.3%
Tractors	96.7	98.0	101.4	101.9	105.1	104.2	100.0	97.2	97.0	102.1	6.6%
Office machinery	100.4	101.8	103.8	104.0	103.3	99.2	100.0	101.3	101.8	110.0	9.6%
Nonresidential furniture and equipment	89.6	94.8	91.5	91.2	100.3	99.0	100.0	103.4	113.6	125.7	40.3%
Durable containers	79.4	86.2	86.4	89.8	104.9	103.1	100.0	100.1	105.4	109.8	38.3%
Professional and scientific equipment	114.7	112.5	107.5	106.1	105.5	105.5	100.0	101.6	105.9	135.7	18.3%
Tools	85.0	89.9	88.4	89.3	97.7	100.1	100.0	99.6	103.9	108.8	28.0%
All other subsidiary durable equipment	90.8	97.8	98.1	97.2	106.0	101.0	100.0	103.0	110.9	116.5	28.3%
Business motor vehicles	85.8	89.8	87.2	88.5	93.0	101.6	100.0	104.1	111.6	120.8	40.8%
Motorcycles	84.6	84.6	85.0	85.4	98.0	100.0	100.0	101.4	101.8	102.6	21.3%
Locomotives and railroad cars	77.8	87.1	92.4	93.2	98.8	98.6	100.0	102.9	109.9	120.0	54.2%
Ships and boats	84.8	90.8	93.7	93.7	100.3	100.3	100.0	103.0	109.9	120.0	41.5%
Composite	86.6	92.9	92.3	92.6	98.9	100.9	100.0	102.6	108.9	115.9	33.8%

Source: Henry Shavell, "Price Deflators for Consumer Commodities and Capital Equipment, 1933–42", *Survey of Current Business*, May 1943, p. 19. (Percentage Variation column supplied)

EXHIBIT 2

sense involves a series of adjustments. These adjustments could be applied to the accounting for such profits in the first instance. The one adjustment which has received a great amount of publicity is the inventory adjustment. This amounted to $5,075 million in 1947, equivalent to 28.1 per cent of corporate net income after taxes as reported in the U. S. Department of Commerce *Survey of Current Business,* July 1948. The purpose of this adjustment is to match current costs against current revenue, thus eliminating inventory profits from income. The effect achieved at least resembles the results of the "lifo" basis of inventory valuation where used. Similarly, some economists have suggested an adjustment for depreciation, i.e., a conversion of depreciation to terms of current prices from original cost. It should be noted that the Department of Commerce does *not* make such an adjustment in its national income estimates.

Fabricant's Index

The economist and the accountant envisage little difference in the problem of converting depreciation based on cost to a charge based on current prices. The technique used in connection with the preparation of national income estimates could well be adapted to accounting purposes. The conversion from accounting to economic measurement of depreciation was derived by Fabricant through the use of two indexes. Fabricant first prepared an index number of prices underlying business depreciation. These index numbers were harmonic means of various available indexes of capital goods and construction costs weighted by the estimated depreciation charge applicable to these goods. The second index was one of prices of business capital goods. To convert from the accounting expression of depreciation to depreciation in current prices, the accounting value was first divided by the appropriate index underlying business depreciation and then multiplied by the index of prices of capital goods.

For the sake of simplicity, the two indexes have been combined and are presented in the center column of Exhibit 1, previously referred to. The application of this index can be illustrated by reference to the depreciation charges for 1919 also shown. Depreciation for 1919 using accounting measurement is shown as $3,411 million and is converted to depreciation expressed in 1919 prices

EXHIBIT 2

Source: Henry Shavell, "Price Deflators for Consumer Commodities and Capital Equipment, 1933-42", *Survey of Current Business*, May 1943, p. 19. (Percentage Variation column supplied)

by multiplying by the index number, 158.8, for that year (Exhibit 1). The result is $5.416 million, the value of depreciation using economic measurement, i.e., in terms of replacement cost.

Wholesale Price Deflators

A less elaborate conversion of depreciation could be obtained by deflating depreciation based on cost through the use of an index of prices of capital goods. The series, as published by the National Income Unit of the Department of Commerce, covers the period 1929-1942 and is referred to as price deflators for capital equipment. (A revised series bringing the data up to date will be available in the near future.) Only part of the series has been reproduced here covering the ten-year period 1933-1942. Exhibit 2 sets forth indexes for specific classes of capital goods and, at the bottom, a composite index.

To illustrate the technique of value depreciation, an asset acquired on January 1, 1939, at a cost of $100,000 and estimated to have a useful life of five years and a scrap value of $10,000 would be depreciated as follows, using the composite price deflator index:

1939	($100,000 — $10,000)	20% × 100.0 = $18,000
1940	($100,000 — $10,000)	20% × 102.6 = $18,468
1941	($100,000 — $10,000)	20% × 108.9 = $19,602

This use of an over-all index, although reflecting a technique which may be desirable in attempting to make adjustments to arrive at the economic net income of all corporations has its shortcomings for accounting purposes. The accountant is faced with the task of making the adjustment for a specific corporation and the index should be derived from prices of the specific capital goods employed by the subject corporation. The use of aggregates may be misleading since the averaging technique may very well understate or overstate price changes in the capital goods employed by a specific company. The extent of possible distortion is apparent by reference to the percentage variation column of Exhibit 2. The composite index increased by 34 per cent between 1933 and 1942 while the individual indexes showed increases ranging from 6.6 per cent to 54.2 per cent. Accordingly, the individual price deflators come closer to serving the needs of the accountant. A more extensive classification of fixed assets of a company would, of course, yield even more accurate results and more than one of these group price deflators might be used in a particular instance.

EFFECT OF DEPRECIATION ADJUSTMENT ON A CORPORATION'S PROFIT 1933-1942
(in thousands of dollars)

Year	(1) Net profit or (loss) after taxes	(2) Depreciation on cost	(3) Index*	(4) Corrected depreciation	(5) Increase or (decrease) in depreciation	(6) Adjusted profit or (loss) after taxes**
1933...	($36,501)	$43,195	86.6	$37,407	($5,788)	($30,713)
1934...	(21,668)	44,121	92.9	40,988	(3,133)	(18,535)
1935...	1,147	47,801	92.3	44,120	(3,681)	4,828
1936...	50,583	55,467	92.6	51,362	(4,105)	54,688
1937...	94,944	59,589	98.9	58,934	655	95,599
1938...	(7,717)	48,533	100.9	48,970	437	(8,154)
1939...	41,119	60,660	100.0	60,660	—	41,119
1940...	102,211	69,085	102.6	70,881	1,796	100,415
1941...	116,171	83,472	108.9	90,901	7,429	108,742
1942...	71,818	91,765	115.9	106,355	14,590	57,228

* Composite index number of wholesale prices of capital equipment (From Exhibit 2).

** Tax provisions not corrected for purposes of this table.

EXHIBIT 3

A Large Company Application

The approach suggested here, based on economic thought and present inclination of many business managements, requires the correction of depreciation based on cost to depreciation measured in terms of current prices, the adjustment being made by the use of indexes of the type introduced above. To illustrate the effects of this in a specific case, Exhibit 3 shows the profits, losses, and depreciation charges as reported by one of the country's largest corporations during the period 1933-1942. The depreciation charges have been corrected by use of one of the composite indexes (although it is recognized that this technique has shortcomings) with the idea of reflecting the over-all impact of the adjustment. Depreciation charges were revised downward for the years of 1932 through 1937, the period during which prices were lower than in 1939. The use of 1939 as 100 is justified on the assumption that prices in this year approximated the average price for the period during which the assets were acquired. For 1938 and 1940 through 1942 the depreciation charges were increased to compensate for increased costs of replacement. The profits or losses are, of course, affected by an equivalent amount but in the opposite direction. No correction has been offered in the exhibit to reflect change in income tax provisions for the respective years.

Possible Adverse Economic Effects of Current Basis Depreciation

It should be noted that the effect of the procedure outlined for depreciation on replacement values, with the calculation based on index numbers of wholesale prices of capital goods, is (as in the "lifo" basis for valuing inventories) the reporting of relatively lower profits during periods of rising prices and relatively higher profits or smaller losses during periods of declining prices than those which would be reported under customary accounting bases. The counter-cyclical effect of these changes has been well discussed by Mr. Blackie in his article referred to earlier in this paper.

However, there are also reasons to believe that these adjustments might have an effect directly opposite to the one generally assumed. This is so because widespread adoption of the replacement cost basis for accruing depreciation charges might well affect management's policies regarding pricing, particularly in certain industries, and this in turn might affect the physical replacement of assets. The points to be noted in this connection are:

1. The increased charge for depreciation might well be reflected in increased total unit costs and would probably be reflected in increased prices of goods sold during periods of generally rising prices. During periods of declining prices, a reduced depreciation charge would have a tendency to result in sharper price reductions than would otherwise occur.
2. To the extent that the depreciation adjustment was reflected in selling prices, the effect would be to convert more or less of the value of fixed assets shown on the balance sheet into current assets. The ability to convert fixed assets to current assets resulting from this accelerated rate of depreciation during periods of rising prices and high profits may produce a more rapid physical replacement of fixed assets than has occurred heretofore. This increased replacement would tend to force even higher the prices of capital goods. By contrast, during periods of declining prices, the much slower rate of conversion yielded by a replacement cost basis would act as a deterrent to physical replacement of assets at a time when capital goods prices are falling and when the individual firm and the economy as a whole would benefit from capital replacement.

It has been found that in past years with depreciation generally based on cost, fixed assets are not replaced as depreciation is charged. Ordinarily depreciation accruals exceed fixed asset acquisitions during the recession and depression phase of the business cycle, while excess expenditures are typical of most concerns during recovery and prosperity. A recent study reveals that in 1929 and in 1937 fixed asset expenditures were one and one-half times depreciation accruals, while in 1932 they were but three-fifths of the provisions for depreciation. (Albert R. Koch, *The Financing of Large Corporations 1920-1939* National Bureau of Economic Research, 1943.) In 1946 and 1947, depreciation accruals for the corporate sector of the economy were $4.1 and $4.3 billions, respectively, while expenditures for plant and equipment were $11.6 and $14.7 billion, to cite figures supplied by Irwin Friend in "Business Financing in the Postwar Period" in the March 1948 issue of *Current Business*.

3. The rapid conversion of fixed assets to current assets during periods of rising prices would yield an increased flow of working capital. As a result industry would be less dependent on outside financing. Therefore, those controls available to the central banking system for retarding undue industrial expansion during the periods of rising prices would be limited to that extent in their effectiveness. The incentives available for encouraging expansion and capital goods replacements during periods of declining prices would by the same token be less productive of results.

Separate Application to Tax and Financial Accounting

There are available tested techniques for expressing depreciation accruals in current prices. The existence of these techniques does not, however, determine the desirability of their adoption and the resultant changes in basic accounting practices. These must be measured against the possible effects of such a policy. The arguments generally presented in favor of the computation of depreciation on replacement cost point to the need for a more practical reporting of profits which considers the high cost of replacing assets. Profits, it is maintained, are overstated under present practice, thus leading to pressure for increased wages and dividends as well as lowered prices. Likewise, the tax bill on

such profits is excessive if they are correctly designated as "overstated."

However, through the techniques discussed, accountants have the means for disclosing the extent to which industry requires larger portions of current revenue to replace production facilities and this information may be supplied to labor, stockholders, and the public as statistical information. This course, which would maintain the advantages of cost depreciation, would seem to answer the proponents of value depreciation effectively.

It is only with regard to profits as a basis for taxation that such disclosure is not effective. An approach to a solution of this portion of the problem may be in changing the tax treatment of depreciation as a separate matter. The tax law already provides for treatment, other than the conventional accounting one, for gains and losses on disposal and exchange of business assets. An appropriate suggestion would be that a similar special treatment for depreciation be enacted into the tax law. Depreciation for tax purposes might well be computed on cost and then adjusted by use of an index number or series of numbers prepared by a governmental agency. A precedent for such use of index numbers is available in the recommendation of the United States Tax Court in the recent Hutzler Bros. decision and subsequent action of the Bureau of Internal Revenue under which acceptable indexes are to serve for tax purposes in the retail inventory field in converting inventories to a "lifo" valuation basis.

COMING ARTICLES

In the *N. A. C. A. Bulletin*, May 1, 1949

Accounting for Government Contracts Under the Armed Services Procurement Regulations
by Robert S. Warner

Sharing Departmental Cost Savings and Over-All Plant Profit with Supervisory Personnel
by Arthur B. Winter

Labor Cost Control Without Clock Cards or Individual Production Time Records
by C. M. Benson and W. H. Donaldson

A PROCEDURE TO IMPROVE CUSTOMER STATEMENTS AND EXPEDITE ACCOUNTS RECEIVABLE AGINGS

by ANGELO J. RALLO,
Chief Accountant, Stecher-Traung Lithograph Corp.,
Rochester, N. Y.

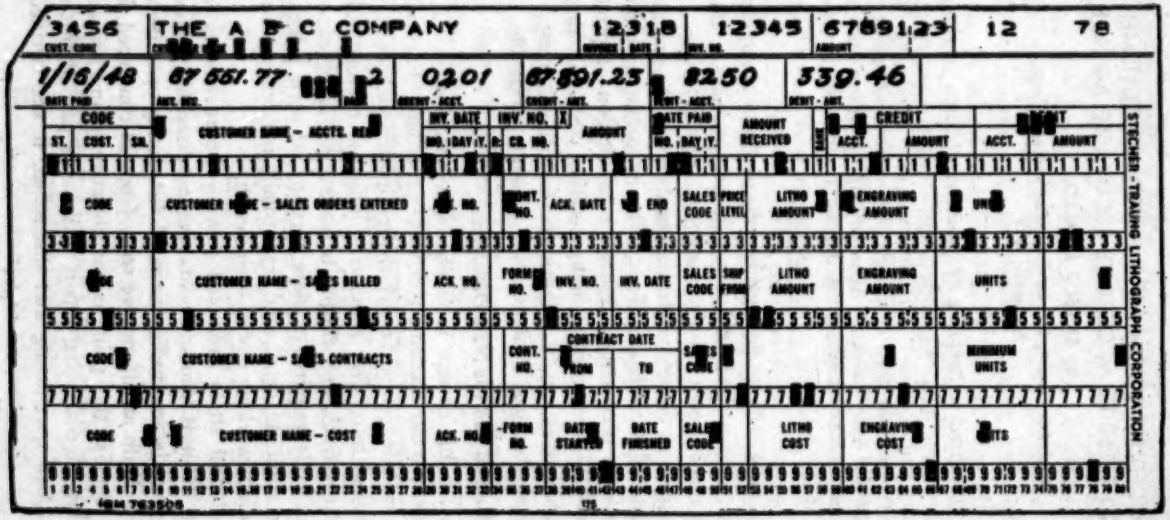
Noting increased importance of financial position in the corporate situation generally, this author describes a method, adopted by his company and requiring part time use of a tabulating installation, which results in aged customer statements and prompt aging information for internal use. Economy of operation and marked improvement in the handling of accounts receivable routine are reported.

TO be of most value to management the products of any accounting process must be modified to reflect the changes in emphasis placed by management on its many problems. During the war years management placed its greatest emphasis on the procurement of raw materials and labor. Today, the important problem is to obtain the cash necessary to finance rehabilitation of productive facilities and to meet current high operating costs. Of the many ways in which cash can be obtained, perhaps the cheapest method is to maintain constant vigilance over accounts receivable.

The Old Method and the New Objectives

In view of this change in emphasis, we decided, in our company, to analyze our accounts receivable procedure. For each customer we had a ledger card to which were posted the various transactions entered into. Our statements indicated opening balances, current transactions, and closing balances. An aging of our accounts receivable required a close scrutiny of each ledger card, was not in sufficient detail, and was usually not ready before the eighth or ninth working day of each month.

The analytical study prompted possible improvements in our procedure. If it is necessary to send out monthly statements, would they not be more effective if we listed only open items and aged them? With an affirmative reply from all concerned, it was agreed to establish this point as one objective in any revised procedure. Our internal aging report was also a part of this study. After thorough questioning and discussion, it was decided that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LITHO AMOUNT
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UNITS
CUSTOMER NAME – SALES BILLED
FORM NO.
INV. NO.
INV. DATE
SHIP FROM
CUSTOMER NAME – SALES CONTRACTS
CONTRACT DATE
FROM
TO
MINIMUM UNITS
CUSTOMER NAME – COST
DATE STARTED
DATE FINISHED
LITHO COST
ENGRAVING COST
STECHER-TRAUNG LITHOGRAPH CORPORATION

EXHIBIT 1

another objective would be to devise a procedure which would furnish the aging more quickly and with more detail.

Use of Tabulating Equipment: The New Procedure in Brief

Having determined our objectives, we began to consider ways and means of achieving them. Inasmuch as we were already using tabulating equipment for payroll and sales analyses, it was not unnatural to consider the use of tabulating cards as one approach to our problem. From the viewpoint of attaining our objectives and from the viewpoint of cost, our investigation revealed that both aims could be served best by changing to a tabulated procedure.

In brief, these are the essential steps in our revised procedure:

1. A tabulating card is punched for each invoice and credit memo. (Exhibit 1)
2. As illustrated, the payment received for each invoice is indicated on the tabulating card representing the invoice and this card is then used in the preparation of our cash receipts journal. (Exhibit 2)

STECHER-TRAUNG LITHOGRAPH CORPORATION
ROCHESTER, NEW YORK
CASH RECEIPTS JOURNAL
DATE _____

CUSTOMER NAME	Cust. No.	AMOUNT RECEIVED	DISC.	INVOICE No.	CREDITS		DEBITS	
					Acct. No.	AMOUNT	Acct. No.	AMOUNT

EXHIBIT 2.

3. After all transactions for a particular month have been recorded on tabulating cards, the cards representing unpaid invoices are listed on an aging report. (Exhibit 3)
4. The same cards are used again to prepare statements which show only invoices outstanding as of the date of the statement. (Exhibit 4)

STECHER-TRAUNG LITHOGRAPH CORPORATION
ROCHESTER, NEW YORK

AGING OF ACCOUNTS RECEIVABLES

DATE _____

CUST. NO.	CUSTOMER NAME	TOTAL	INVOICE DATE	AMOUNT DATE	CURRENT	30 DAYS	60 DAYS AND OVER	SPECIAL	REMARKS

EXHIBIT 3

Effecting the Change-Over

The transition from the previous procedure to a tabulating card method entailed certain definite steps in addition to the designing of forms and cards. An alphabetical list of all our customers was made and each customer assigned a code number. Care was taken to allow for the addition of new customers in the proper alphabetical sequence. Using the new code numbers, master name and address cards were punched for each customer. One other task was the assignment of code numbers to all our general ledger accounts. This completed the necessary coding operations. All was now in readiness to make the change on January 1, 1948.

The final step in the change-over consisted of punching tabulating cards for the balances on each ledger card. We carefully ana-

STATEMENT

STECHER-TRAUNG LITHOGRAPH
CORPORATION
ROCHESTER DIVISION - 274 N. GOODMAN ST. ROCHESTER 7, N. Y.

THE ABC COMPANY
ROCHESTER, N.Y.

DATE		
NO.	DAY	YR.
12	31	48

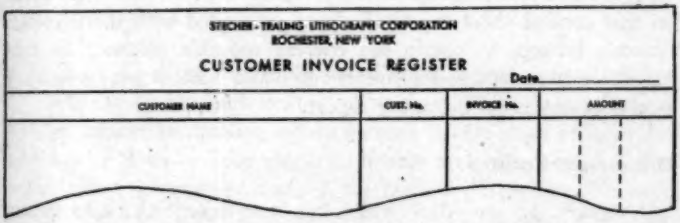
INVOICE DATE		INVOICE NO.	CHARGES			CREDITS			CREDITS AND OTHER			TOTAL		
MO.	DAY													
10	22	10039								367	10			
11	17	11246					900	00						
12	31	12345	67	801	23							69	158	33

EXHIBIT 4

lyzed all ledger cards and punched tabulating cards for invoices and credit memos outstanding on each account. The change-over was now complete.

The Procedure in Operation

To effectively limit possible errors, controls have been established for each step in the procedure. Whenever a group of invoices is given to the tabulating clerk, there is attached an adding machine tape of the amount of the invoices. The invoice card punched for each invoice is listed on a daily invoice register (Exhibit 5) and the total of the register must agree with the total on the adding machine tape. The invoice cards then are returned to the accounts receivable clerk who files them by customer in an open item file.


STECHER-TRAUNG LITHOGRAPH CORPORATION
ROCHESTER, NEW YORK

CUSTOMER INVOICE REGISTER

Date

CUSTOMER NAME	CUST. No.	INVOICE No.	AMOUNT

EXHIBIT 5

When a check is received in payment of an invoice or a group of invoices the accounts receivable clerk pulls the invoice cards from the open file and manually indicates the date of payment, the amount received, the credit account and amount, and the debit account and amount. An adding machine tape of the amounts received, as shown on the tabulating cards, is always compared with the amount of the bank deposit at this stage.

In the tabulating department the remittance information is punched into the invoice card and the cards are then used to obtain a listing of the cash received for that particular day. These cards are filed in the tabulating department until the receipts for the last day of the month have been listed. Then the cards are sorted by account numbers and a cash receipts summary is prepared on the tabulating machine. This summary is the basis for posting to the general ledger.

Occasionally a remittance is only a part payment on an open balance or may be for purposes for which an invoice has not been

rendered. In these instances the accounts receivable clerk lists the miscellaneous cash receipts on a special form on which is indicated the same information as shown on the paid invoice card. The total miscellaneous cash received becomes a part of the adding machine tape taken of the paid invoice cards. When given to the tabulating department a receipts card is punched and listed as part of the cash received for that particular day. This card is identical in form to the invoice card but has a colored edge.

Manual Control of Aggregate Receivable Balance

As cards are punched for each group of invoices, credit memos, or cash receipts, the totals on the cards are carefully checked with the totals on the adding machine tapes. Each total is then recorded on a control sheet. At the end of each month the items recorded on this control sheet are totalled and combined with the previous month's balance to obtain the current month's balance. In this manner we establish the accounts receivable control total which we expect to obtain on the aging report.

Advantages Realized

Although the procedure which has been described might appear to require more clerical hours than the previous method, the exact opposite is the case. The individual tabulating operations are relatively short. The only lengthy reports are the aging report and the statements and these can be prepared in four hours. The important consideration is the fulfillment of our objectives. On the third working day of each month an aging report is prepared in duplicate with one copy going to the credit manager and one copy to the treasurer. Our statements are not clouded by opening balances and closing balances but indicate clearly the exact amount outstanding and the individual invoices, credit memos, or cash payments which make up that balance. In addition, each invoice is listed in the proper column so that overdue amounts can be spotted very quickly.

Our new procedure has been in operation for one year and we believe that it is a marked improvement over our former methods. The judge in these matters is the representative of management concerned with collections in particular and cash in general. He has a new and better tool at his disposal.

AN EFFECTIVE GROUP INCENTIVE PLAN FOR SMALLER COMPANIES

by ARTHUR L. BENNETT,
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As this paper points out, there are possible snags in incentive installations which may make them—contrary to their principal objective—costly in the shop and in the office. The article comprises an exposition of a wage incentive installation in a company in which the operating situation made it appropriate to take advantage of the relative simplicity of group incentives and where the difficulties of handling indirect departments and "off time study" work for incentive purpose were solved on a practical basis.

ONE of the most frequently heard criticisms of wage incentive systems is the high cost of operation. This is particularly true in smaller companies, where because of the small volume, the addition of three or four clerks to handle the wage incentive plan would offset the savings made in the factory. However, this need not be true. If proper attention is given to all phases of the work, including clerical, when the system is designed, the result can be satisfactory both from the standpoint of shop efficiency and low cost operation. It usually is not practical for a small company to obtain the perfection found in larger organizations and many corners must be cut. The system must be designed to supply all of the main advantages but few of the refinements of the larger installations.

A Group Plan Based on Standard Earned Hours

I would like to present such a system. It was designed to fit particular conditions and should not be taken either as a model or as an ideal. It is meant only as an illustration of some of the things which can be done to gain the advantages of wage incentive with a low operating cost. The system has worked satisfactorily for three years and has proven its value.

The first step in the installation was the decision as to whether an individual or group bonus incentive system should be employed. The latter type was chosen for three reasons:

1. The shop naturally and functionally operated in groups.
2. It was felt that a group bonus would increase cooperation and eliminate friction between employees and claims of "soft jobs."
3. The group bonus would require far less clerical work than individual piece rates.

The system is the common "standard earned hours" system under which payment is made by applying a flat percentage bonus to the base pay of each employee in the group. The percentage is determined by dividing the total standard hours for the pieces produced by the group by the total hours worked by the group to produce these standard hours.

Production Count: Service Departments: Time Study Unit

The plan covers several different types of operations from power press work to assembly line work, involving four to sixteen operators in a group.

The problem of where and when to count was solved by making the inspection point serve as the counting point. Since it was necessary, for quality control reasons, to have the inspector count the work and report the number of good pieces and the number of rejects, no expense was added at this point for the wage incentive system. A copy of the inspection report was used as the official report of production on bonus. To avoid the possibility of cheating either the worker or the company, a strict rule was made that no pieces were to be counted without moving them to the next operation and that no work was to be moved before it was counted.

Fortunately the factory divided itself into natural groups. Each department is engaged either in a different type of work or in making a different part of the product. Therefore each department became a separate bonus group. To make it possible for the servicing departments to share in the bonus without attempting to set up work standards in these departments, it was decided to pay the personnel involved the average bonus of employees in all operating departments. However, the only indirect departments included in the incentive are those departments which directly service the factory, such as the raw stockroom.

It proved necessary in connection with the plan to set up a time study and methods departments, consisting of two men, but the cost of operating this small unit cannot be charged entirely against

the bonus plan, since opportunity was taken to assign to two new departments the jobs of tool control, discovering the best production method, and liaison work between the factory and the engineering department. Because of this, the introduction of this department has made possible additional savings not effected by the bonus plan alone.

Work Not Covered by Time Study—Two Types

Up to this point no mention has been made of the handling for incentive purposes of time spent on jobs not covered by a time study. This was the most difficult problem faced in the installation. As the exception proves the rule, so also does the wage incentive stand or fall on the handling of work other than straight bonus jobs. If every minute of the worker's day could be covered by a job on which a standard has been established and if the worker could have an unlimited supply of the proper material with no delays from part failure or machine breakdown, there would be few problems with wage incentives. It is the existence of these problems that not only adds to shop costs but also increases clerical costs in connection with the operation of the incentive system. Since they do increase costs, they should be given the greatest consideration during the design of the system which, by its very intent, is directed to the reduction of cost.

The three most common methods of payment for work not covered by time study and where an incentive system is in force are:

1. Base hourly rate.
2. Special delay rate.
3. Fixed bonus allowance.

The first method raises objections on the part of the worker since he is deprived of bonus earnings through no fault of his own. It also results in increased work for the payroll department since it means extra calculations and, as a final result, it tends to defeat the object of the group system since all operators are not sharing equally. The second method eliminates the worker's objection, but the other two still apply. The third method was the one chosen, since it had none of the disadvantages of the other two methods and, in addition, it makes some of the cost work easier, as we shall see later on. In the system under study the nonbonus time was divided into two classes, that over which the group exercised some control and was of short duration and that over which the group

had little or no control and which would usually be of longer duration. It may not always be possible to make this distinction. In this case it was.

Payments for Rework and Training Time

The latter class of nonbonus time includes rework or repairs for which the group is not responsible, caused for the most part by vendor's failure to make parts as specified or changes in design or specification making it necessary to rework parts already produced. Ordinarily vendor material not up to specification is returned. However, in some instances it is advisable to make minor alterations in the plant rather than wait for new parts. Besides rework, training time is included in nonbonus time for which the group is not held responsible. Although new employees do not share in the bonus until they have passed their training period, employees who have been sharing in the bonus are from time to time transferred to other jobs or other departments and a certain amount of learning time is necessary. It was not deemed fair to the employee or the group to charge this training time against the group. Both rework and training time are paid for at the average hourly bonus rate of the group for the week in which they occur.

Idle Time, "No Standard" Jobs, etc.

The other type of off-time study work, that characterized by relatively brief duration and sometimes by group responsibility, is paid for as standard bonus equal to a fixed percentage of actual hours of this type. The percentage does not matter—it is the method which counts. The actual hours in this category of work are included in with the actual hours on production when the group's ratio of standard earned bonus to actual is calculated, and the standard hours determined by applying the fixed percentage are included with the standard hours earned. In this manner any loss in incentive which might otherwise have been earned is shared by all employees in the group and no claims of partiality can be made. The type of work covered by this class includes:

1. Idle time
2. Jobs on which no standard has been set.
3. Machine setup by the operator.
4. Delays caused by poor flow of material.
5. Departmental clean up.

It can readily be seen that this method has two distinct advantages. First, delays and other special circumstances are no different than a bonus job as far as the bonus calculations are concerned and the payroll department has only one percentage to use in calculating bonus pay for the group. Secondly, while three hours of delay could seriously affect the earnings of the worker if charged against a single operator the effect is insignificant when spread over the earnings of a large group. To the company the cost would be the same in either case.

Weekly Spread Sheet for Each Incentive Group

The second phase of the incentive installation job was setting up the actual method of bonus calculation. It is at this point that the clerical cost of operating the system is incurred. The company is operating on standard cost system and the ultimate goal with respect to incentive calculation was a method which would combine the bonus calculation with the computation of direct labor variances and the distribution of direct labor payroll. The final result was a single departmental bonus spread sheet which accomplished just that. This spread sheet is illustrated by Exhibit 1. An attempt will be made to point out enough of its highlights to give a fair picture of how it works. The principles involved could, I believe, be applied to many different types of systems.

The sheet contains a complete picture of the labor activity of a single group. It is necessary to use a separate sheet for each bonus group. There are three sections vertically. The first section is used to record the direct productive jobs. The second section is used to record the time paid for in terms of standard hours as a fixed percentage of the related actual bonus as previously explained. The third section is used to record the time to be paid at average bonus (learning and rework) and to record time spent on indirect labor such as personnel loans to indirect departments. Horizontally the form allows for job description, standard time data, and for production, time, and cost information for each day of the week (except Sunday) and for the week as a whole. For simplicity, the Tuesday to Saturday columns have been dropped from Exhibit 1.

Section 1. The part numbers and descriptions of the current productive jobs are listed in the space provided and the standard time allowed, in hours per piece, is entered in the proper space opposite each job. Production for each day is recorded opposite

		Unit Std Time	Monday				Weekly Totals					
			Quantity Produced	Standard Time	Actual Time	Actual Cost	Quantity Produced	Standard Time	Actual Time	Actual Cost	Std Cost	Total Wages
	DIRECT LABOR:											
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26	TOTAL DIRECT LABOR ITEMS											
	INDIRECT LABOR & VARIANCES:											
27	IDLE TIME											
28	ALLOWANCE FOR BONUS MAKEUP											
29												
30												
31	TOTALS											
32	DAILY BONUS PERCENTAGE											
33	ACCUMULATIVE TIMES											
34	ACCUMULATIVE BONUS PERCENTAGE											
35	TOTAL LABOR COST IN GROUP											
36	DIRECT LABOR - DAYWORK (LINE 35 LESS LINE 31)											
37	DIRECT LABOR - BONUS (BONUS PERCENT X LINE 32)											
38	DIRECT LABOR - TOTAL (LINE 36 + LINE 37)											
39	LABOR TIME VARIANCE (NET) BONUS PERCENT X LINE 33											
40	TOTAL STD TIME LINE 26 X DEPT STD HOURLY RATE											
41	METHOD & ENG'G VARIANCE - DR (LINE 40 LESS LINE 26)											
42	METHOD & ENG'G VARIANCE - CR (LINE 26 LESS LINE 40)											
43	LABOR RATE VARIANCE - DR (LINE 38 LESS LINE 33%)											
44	LABOR RATE VARIANCE - CR (LINE 33% LESS LINE 38)											
	INDIRECT LABOR OUTSIDE OF GROUP:											
45	SUPERVISION - GROUP LEADER											
46	LEARNING TIME											
47	SET UP											
48	REPAIRS TO DEFECTIVE MATERIAL											
49												
50												
51												
52	INDIRECT BONUS COST - DR (LINE 54 LESS LINE 37)											
53	INDIRECT BONUS COST - CR (LINE 37 LESS LINE 54)											
54	TOTAL BONUS FROM PAYROLL											

Section 1

Section 2

Section 3

EXHIBIT 1

the job under the heading, "Quantity Produced." As previously mentioned, this information is obtained from the inspection reports. A comptometer is used to extend pieces produced times the standard time per piece and the results are entered under "Standard Time." The actual hours worked on each job are entered under the heading "Actual Time." The hours to be paid for on the fixed percentage basis are listed following the productive jobs, with the appropriate explanation and with entries in the "Actual Time" column only. This completes the first section which closes with line 26 on Exhibit 1, displaying totals for standard and actual hours.

Section 2. It will be apparent that the group bonus ratio cannot be obtained by dividing total actual hours, into total standard hours at this point, for standard hours do not yet contain an amount representing the standard hours equivalent of the last mentioned group of jobs. This is entered in Section 2 on line 28, computed at the percentage in use applied to the actual hours in question and the figure is placed in the "Standard Time" column opposite "Allowance for Bonus Makeup." It is now possible to draw down standard and actual hour totals on line 31 which can be used to compute the group bonus ratio to be entered on the line following. This is figured daily for employee information but modified as the week goes on by the operation of lines 33 and 34 which result in a bonus ratio applicable to the week as a whole for application to the base pay for each employee.

Although this completes coverage of Section 2 of the form for incentive purposes, it should perhaps be mentioned for completeness that the actual time column in this section carries figures opposite the captions "Idle Time" and "Allowance for Bonus Makeup" so that they can be priced at the average department rate to disclose the cost of this factor in operations and to assist in the mechanics of variance calculations as noted later. However, an offsetting red figure is also entered in the "Actual Time" column because, for bonus calculation purposes, the actual time has already been recognized in Section 1 of the form. This pricing operation is a costing rather than an incentive or payroll feature.

Section 3. It will be quickly apparent, from the diagonal lines blocking out all but weekly total actual cost or weekly total standard cost columns, that the third section of the spread sheet is principally devoted to cost disclosure. However, lines 45 to 48 do re-

quire actual hours to complete the picture of labor activity and the position of this data, which includes training and rework time, *after* determination of the bonus percentage serves as a reminder that these hours do not affect calculation of the percentage although, as previously indicated, they are compensated, like all other labor hours in the department, at that percentage applied to base pay. Here is perhaps the place to restate also that personnel of indirect departments servicing the factory are paid at a bonus rate each week which averages those of all productive departments. The bonus rate for each department is reported to the payroll department where the payroll is calculated at base hourly rate, the bonus per cent are applied and gross pay for each individual arrived at. The payroll is totaled separately for each group to show both base pay and bonus.

Cost Control Information

It was said earlier that bonus rate determination is integrated with development of cost control data. This is a "natural" because the spread sheet shows full labor activity for each group. The sheet is first totaled vertically and horizontally and its balance proved by cross-totaling of footings. At this point we begin to assemble our cost information. Columns are provided under "Weekly Totals" for unit standard cost and total standard cost. The production is costed out at standard and totaled. This shows the standard value of the production for the week.

From the payroll department is obtained the total base pay and total bonus for each group. However, the departmental indirect time paid at average bonus does not form a part of productive labor. For that reason the cost of such time at base rate is deducted from the base payroll and the net figure is entered on the sheet at line 35 as "labor cost in group." By subtracting also the cost of the indirect hours paid at the fixed percentage we arrive at the cost of the direct labor at base pay in line 36. The bonus percentage is applied to the total labor in the group (line 32) and the sum of the base pay plus bonus equals the total actual direct labor as shown in line 38, and serves to strike off variances as indicated in the next paragraph.

The total standard hours earned (exclusive of fixed percentage jobs) multiplied by the departmental average rate as of the first of the year is entered in the proper space in line 40. This figure,

compared with the total direct labor two lines above, shows the variation due to rate changes since payroll has been caculated at actual hourly rates and the average rate is standard. By comparing the standard hours times average rate (line 30, as noted above) with the standard cost of the pieces produced in line 26, we obtain the variation due to changes in time standards. Both of these variances are entered on the sheet.

Summary

At the beginning of this article it was mentioned that this group incentive system is one which combines the advantages of the more complete systems with low cost operation. A brief review should serve to show how completely this has been done. First of all, it pays the workers in direct proportion to the effort expended which is the object of all incentive systems. Second, since it is a group bonus, variations and delays—always more prevalent in smaller organizations—have less effect on the earnings of the individual than if an individual incentive system were in effect. All time spent by the worker is covered, both productive and nonproductive, and appropriate payment is made. It might be well at this point to mention that workers temporarily transferred to a job in a department not covered by the system (this will be a nonproductive department not directly serving the factory) are paid the bonus of their usual group.

From a cost control standpoint the following information, by departments, is provided by the data on the labor spread sheet, Exhibit 1, which we have been interested in for the purposes of this article primarily for its use in computing the weekly bonus percentage for each department:

1. Production.
2. Actual hours worked.
3. Bonus earned.
4. Indirect labor cost by items.
5. Total direct labor.
6. Direct labor variances due to rate changes.
7. Direct labor variances due to changes in methods.
8. Total standard cost of production.
9. Bonus paid on indirect work.

Cost entries are made from this record and reflected in the general ledger. Reports on indirect labor are submitted to the factory for their guidance. The entire job of working the spread sheet, both for incentive computation and cost control purposes, is done by one employee in the cost department.